Practical 3

Q.Define an abstract class Shape in package P1. Inherit two more classes: Rectangle in package P2 and Circle in package P3. Write a program to ask the user for the type of shape and then using the concept of dynamic method dispatch, display the area of the appropriate subclass. Also write appropriate methods to read the data. The main() function should not be in any package.

Code:-

P1/Shape.java

```
package P1;
public abstract class Shape {
protected abstract void getData() throws java.io.IOException;
public abstract double area() throws java.io.IOException;
}
```

P2/Rectangle.java

```
package P2;
import java.io.*;
import P1.*;
public class Rectangle extends Shape {
private double length;
private double breadth;
protected void getData() throws IOException {
BufferedReader br = new BufferedReader(new InputStreamReader(
System.in
));
System.out.print("Enter Length of Rectangle: ");
length = Double.parseDouble(br.readLine());
System.out.print("Enter Breadth of Rectangle: ");
breadth = Double.parseDouble(br.readLine());
}
public double area() throws IOException {
getData();
return length * breadth;
}
}
```

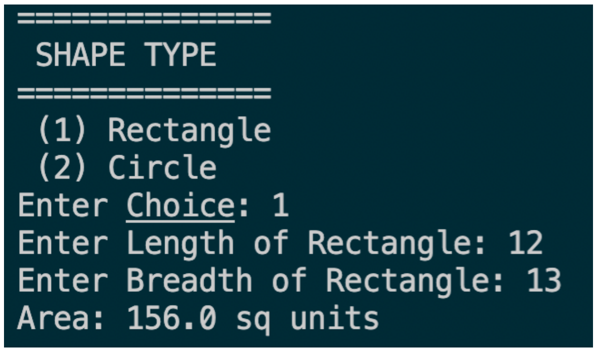
P3/Circle.java

```
package P3;
import java.io.*;
import P1.*;
public class Circle extends Shape {
private double radius;
protected void getData() throws IOException {
BufferedReader br = new BufferedReader(new InputStreamReader(
System.in
));
System.out.print("Enter Radius of Circle: ");
radius = Double.parseDouble(br.readLine());
}
public double area() throws IOException {
getData();
return Math.PI * radius * radius;
}
}
```

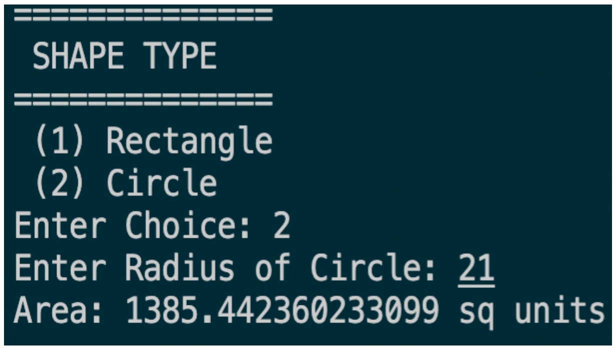
practhree.java

```
package Dhruv_Java.Dhruv_Java;
import java.io.*;
import Dhruv_Java.P1.*;
import Dhruv_Java.P2.*;
import Dhruv_Java.P3.*;
public class practhree {
 static int getShapeType() throws IOException {
 BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
 System.out.println("==============\n SHAPE TYPE \n==============");
 System.out.println(" (1) Rectangle\n (2) Circle");
 System.out.print("Enter Choice: ");
 return Integer.parseInt(br.readLine());
}
 public static void main(String[] args) throws IOException {
 Shape ref;
 boolean flag = false;
 while (!flag) {
 switch (getShapeType()) {
 case 1:
 flag = true;
 ref = new Rectangle();
 System.out.println("Area: " + ref.area() + " sq units");
 break;
 case 2:
 flag = true;
 ref = new Circle();
 System.out.println("Area: " + ref.area() + " sq units");
 break;
 default:
 System.err.println("Invalid Option");
 break;
 }
 }
 }
}
```

Output:-



```
===============
 SHAPE TYPE
===============
 (1) Rectangle
 (2) Circle
Enter Choice: 1
Enter Length of Rectangle: 12
Enter Breadth of Rectangle: 13
Area: 156.0 sq units
```



```
===============
 SHAPE TYPE
===============
 (1) Rectangle
 (2) Circle
Enter Choice: 2
Enter Radius of Circle: 21
Area: 1385.442360233099 sq units
```

Practical 4

Q.Create an Exception subclass UnderAge, which prints "Under Age" along with the age value when an object of UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the method test() throws UnderAge exception if the variable age passed to it as argument is less than 18.
Write main() method also to show working of the program.

Code:-

Underage.java:

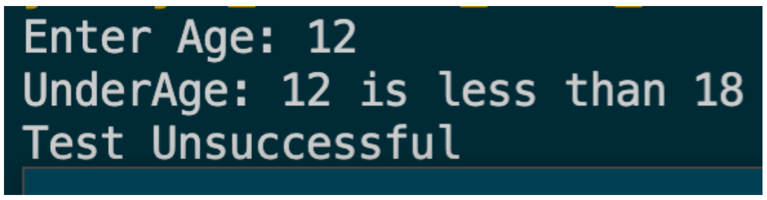
```
package Dhruv_Java;

public class underage extends Exception {
   final private int age;
   public underage(int age) {
   this.age = age;
   }
   @Override
   public String getMessage() {
   return "UnderAge: " + age + " is less than 18";
   } }
```

exceptionDemo.java:

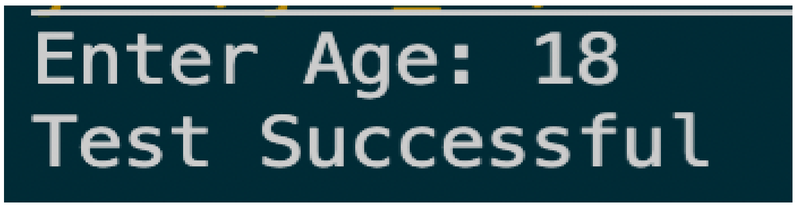
```
package Dhruv_Java;

import java.util.Scanner;
class exceptionDemo {
 static void test(int age) throws underage {
```

```
if (age < 18)
throw new underage(age);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.print("Enter Age: ");
int age = sc.nextInt();
try {
test(age);
System.out.println("Test Successful");
} catch (underage e) {
System.err.println(e.getMessage());
System.out.println("Test Unsuccessful");
}
finally {
sc.close();
}
} }
```

Output:-



```
Enter Age: 12
UnderAge: 12 is less than 18
Test Unsuccessful
```



```
Enter Age: 18
Test Successful
```

Practical 5

Q.Write a program to implement stack. Use exception handling to manage underflow and overflow conditions.

Code:-

Stack.java:

```
package Dhruv_Java;

public class Stack {
   private int tos;
   private int[] array;
```

```
    final private int size;
    public Stack(int size) {
    this.tos = -1;
    this.size = size;
    this.array = new int[this.size];
    }
    public void push(int e) throws StackException {
    if (tos == size - 1)
    throw new StackException("Stack Overflow: could not push " + e);
    else
    this.array[++this.tos] = e;
    }
    public int pop() throws StackException {
    if (this.tos < 0) {
    throw new StackException("Stack Underflow: could not pop");
    } else
    return this.array[this.tos--];
}
    public int getTOS() {
    return this.tos;
    }
    @Override
    public String toString() {
    return "Stack<size=" + this.size + ">";
    } }
```

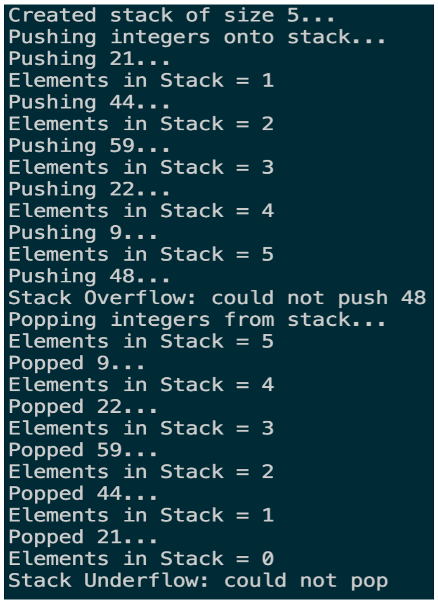
StackException.java:

```
package Dhruv_Java;

public class StackException extends Exception {
    final private String message;
    public StackException(String message) {
    this.message = message;
    }
    @Override
    public String getMessage() {
    return this.message;
    }
}
```

pracfive.java:

```
package Dhruv_Java;

import java.util.Random;
public class pracfive {
 public static void main(String[] args) {
 int r;
 Stack stack = new Stack(5);
 Random random = new Random(1337);
 System.out.println("Created stack of size 5...");
 System.out.println("Pushing integers onto stack...");
 while (true) {
 r = random.nextInt(100);
 System.out.println("Pushing " + r + "...");
 try {
 stack.push(r);
 System.out.println(
 "Elements in Stack = " + (stack.getTOS() + 1)
 );
 } catch (StackException e) {
 System.err.println(e.getMessage());
 break;
 }
 }
 System.out.println("Popping integers from stack...");
 while (true) {
 System.out.println(
 "Elements in Stack = " + (stack.getTOS() + 1)
 );
 try {
 System.out.println("Popped " + stack.pop() + "...");
 } catch (StackException e) {
 System.err.println(e.getMessage());
 break;
 }
 }
 } }
```

Output:-



```
Created stack of size 5...
Pushing integers onto stack...
Pushing 21...
Elements in Stack = 1
Pushing 44...
Elements in Stack = 2
Pushing 59...
Elements in Stack = 3
Pushing 22...
Elements in Stack = 4
Pushing 9...
Elements in Stack = 5
Pushing 48...
Stack Overflow: could not push 48
Popping integers from stack...
Elements in Stack = 5
Popped 9...
Elements in Stack = 4
Popped 22...
Elements in Stack = 3
Popped 59...
Elements in Stack = 2
Popped 44...
Elements in Stack = 1
Popped 21...
Elements in Stack = 0
Stack Underflow: could not pop
```